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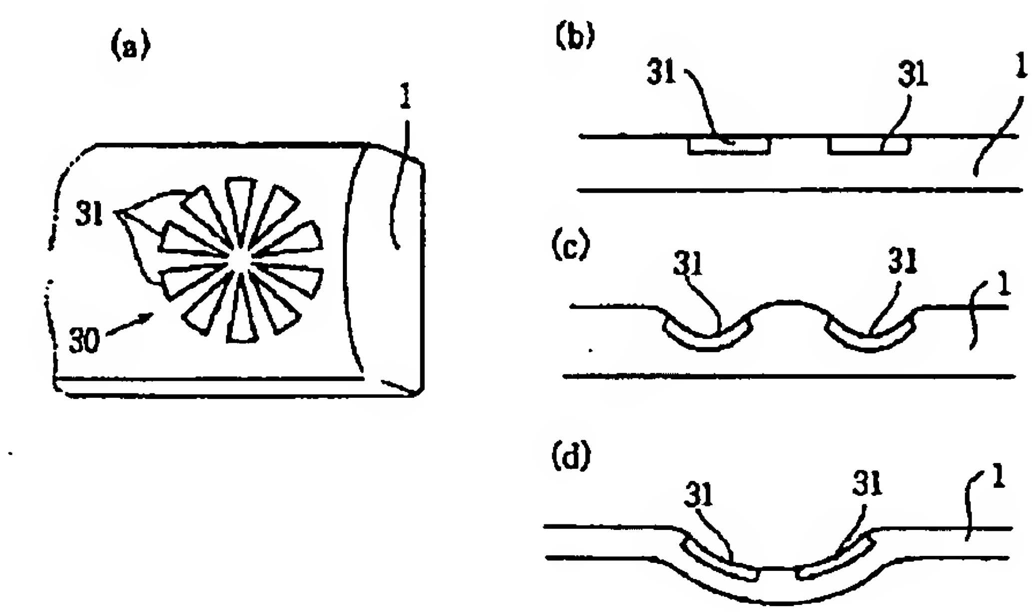
(57) **[Abstract]**

[Object] To reduce the thickness of a control panel and improve operability with a simple constitution.

[Constitution] When a finger is, for example, turned while touching a switch unit 30 having a plurality of sensor units disposed on an operation face of a control panel 1, the on/off states and/or the changes of the sensor units are detected. Furthermore, by causing the switch unit 30 to be of the film type, for example, this can be disposed, not only on a flat surface, but also on a curved surface.

[Effect] A conventional rotary element 3 can be rendered unnecessary, and the thickness of the control panel can be reduced. Furthermore, the operational trajectory is not limited, and because the rotational movement of the finger can be in any shape, operations can be performed easily.



[CLAIMS]

[Claim 1] A jog-dial switch characterized by comprising a contact or non-contact switch unit, on the top face of which are disposed a plurality of detection units, and control means that output a predetermined output signal in accordance with an on/off state and/or a change in this switch unit.

[Detailed Description of the Invention]

[0001]

[Field of Industrial Application] The present invention relates to a jog-dial switch for forward and reverse slow motion, frame advance, turning the volume up/down and the like, for a VTR, CD player, video disc player, DAT or the like.

[0002]

[Prior Art] Recently, jog-dial switches have been adopted for forward and reverse slow motion, frame advance, turning the volume up/down and the like, for VTRs, CD players, video disc players, DATs and the like.

[0003] In such jog-dial switches, for example as shown in FIG. 1 and FIG. 2, a rotary member 3, which is positioned in a recess 2 in a control panel 1, is mounted on a rotary shaft 6 of a rotary encoder 5, which is mounted on a printed circuit board 4.

[0004] When operated, for example, if a video is to be frame advanced slowly, the rotary member 3 is grasped and rotated to the right or the left. Conversely, if this is to be frame advanced quickly, the tip of a finger is lightly pressed into a hollow 3a in the rotary member 3, and in this state the rotary member 3a [*sic*] is rotated quickly by turning the finger. Thus, the direction of rotation and amount of rotation are detected by way of a signal from the rotary encoder 5 and, depending on the result of this detection, a signal for indicating the video frame advance direction and amount, or speed, is output to the playback mechanism from a control unit, not shown in the drawing.

[0005] In terms of the operating principles of such a rotary encoder 5, for example, JP-52-142411-A discloses that, as shown in FIG. 3 and FIG. 4, the indicator signal mentioned above is produced on the basis of light, which is interrupted by openings 11, 12 in a disc 10.

[0006] In the rotary encoder 5, the disc 10, having openings 11, 12 which partially overlap with each other in the angular direction, is rotatably mounted on a shaft 15, which serves as a bearing. Light emitting diodes 25, 26 and photo transistors 22, 23 are provided facing each other at positions corresponding to the openings 11, 12. By rotating the disc 10, the light [beams] from the light emitting diodes 25, 26 are interrupted, producing a pair of square waves as the collector outputs from the photo transistors 22, 23.

[0007] The collector output of the transistor 22 is applied to the clock input of flip-flops 16, 17 via an amplifier 18, and the flip-flops 16, 17 are triggered by the falling edge of the collector output of the transistor 22.

[0008] The collector output of the transistor 23 is applied to the D input of flip-flop 17 via an amplifier 19.

[0009] Now, when the disc 10 rotates in the clockwise direction and an edge 14 of the opening 11 passes the light emitting diode 25, the collector output of the transistor 22 goes from high level to low level, the flip-flop 16 is triggered by the falling edge thereof, and logical 1 is generated at the Q output. This signal is used as an interrupt signal for a microprocessor, and when the micro processor receives this interrupt, it applies a reset signal to the R input of the flip-flop, so as to reset it. Consequently, a pulsed signal is produced corresponding to the number of times that the opening 11 has passed, which is to say, corresponding to the amount of rotation.

[0010] The direction of rotation is determined according to the Q-bar output of the flip-flop 17. In other words, when the disc 10 rotates in one direction, logical 1 is generated at the Q-bar output of the flip-flop 17, and when the disc 10 rotates in the other direction, logical 0 is generated at the Q-bar output of the flip-flop 17. In other words, this is because, data that indicates presence/absence is applied to the D input of the flip-flop 17 when the clock signal is generated, so it is known of which of the edges 14, 13 of the opening 11 generated the clock signal.

[0011]

[Problems to Be Solved by the Invention] Thus, in a conventional jog-dial switch such as described above, by rotating the rotary member 3 shown in FIG. 1, the direction of rotation and amount of rotation can be detected by way of the rotary encoder 5 and a signal can be produced for the purpose of indicating the direction and amount, or speed, for video frame advance, for example.

[0012] However, with the jog-dial switch described above because the rotary member 3, which is a mobile unit, is required, as shown in FIG. 2, the number of parts is increased and, structurally, there is a limit to how thin the jog-dial switch can be made, which is an impediment in reducing the thickness of the control panel 1.

[0013] Moreover, when the rotary member 3 is to be rotated quickly, as described above, this is performed by lightly pressing the tip of a finger into the hollow 3a and turning the finger in this state; but in this case, because the rotational path of the finger is determined by the diameter between the center of the rotary member 3 and the hollow 3a, the rotational motion of the finger is restricted, which is disadvantageous in that operability is inferior. It should be noted that the faster the rotary motion of the finger is, the more difficult it becomes to move in a perfect circle, and the movement naturally becomes irregular.

[0014] The present invention was developed in response to such a situation, and an object thereof is to provide a jog-dial switch whereby the thickness of the control panel can be reduced and operability can be improved, with a simple constitution.

[0015]

[Means for Solving the Problems] In order to achieve

the aforementioned object, the jog-dial switch of the present invention is characterized by comprising a contact or non-contact switch unit, on the top face of which are disposed a plurality of detection units, and control means that output a predetermined output signal in accordance with an on/off state and/or a change in this switch unit.

[0016]

[Operation] With the jog-dial switch of the present invention, the direction of rotation and the amount of rotation are detected based on the contact or non-contact based on/off states and/or changes of a plurality of detection units disposed on a surface, allowing a conventional rotary member to be rendered unnecessary.

[0017] Furthermore, by causing the switch unit to be of the film type, the places in which this can be disposed, are not limited to flat surfaces, but rather this can also be disposed on a curved surface

[0018] Furthermore, the operational trajectory is not limited in the way that it is when a conventional rotary member is used, and because the rotational movement of the finger can be in any shape, operations can be performed easily.

[0019]

[Embodiments] Hereafter, detailed embodiments of the present invention are described by way of the drawings. Note that, in the drawings described below, the same reference numerals are given to parts that are common to FIG. 1 through FIG. 4, and duplicate descriptions are omitted.

[0020] FIG. 5 shows one embodiment of a jog-dial switch of the present invention; a capacitance type touch switch unit 30 is provided on an operating face of a control panel 1. The switch unit 30 is provided with a plurality of sensor units 31, provided in a chrysanthemum pattern. The sensor units 31 are provided level with the control panel 1, so that there is no unevenness.

[0021] When the switch unit 30 is operated, for example, as shown in FIG. 6, by tracing the surface of the sensor units 31, the direction of rotation and the amount of rotation are detected as described below. At this time, as in (c) and (d) in the same drawing, guide grooves and guide protrusions can be provided at the surfaces of the sensor units 31, or a protrusion or the like may be provided between the sensor units 31, and if this is the this case, blind touching is possible, so that the sensor units 31 can easily be traced.

[0022] Note that the switch unit 30 is not limited to the touch type of this example, and may be of the non-touch capacitance type, or may be constituted by other detection means, such as pressure sensors.

[0023] It is of note that, in cases where non-touch capacitance type, pressure sensors or the like are used for the switch unit, it is not necessary to expose electrodes on the surface of the control panel 1, whereby the operating face of the control panel 1 can be made uncluttered.

[0024] A switch unit 30 of this sort can be formed, for example, by the hot stamping shown in FIG. 7. Specifically, in this method, a transfer film is thermocompressively bonded onto the control panel 1, which is a molded article, using a transfer machine. In the transfer film, an adhesion layer 31a, a sensor layer 31b, a coloration 31c, and a separation layer 31d, which constitute a foil layer 31A, are stacked on a base film 31e. With the adhesion layer 31a side pressed against the operation surface side of the control panel 1, the entire transfer film is thermocompressively bonded to the control panel 1, whereafter the base film 31e is peeled off, so as to form the foil layer 31A, which constitutes the sensor unit 31, on the panel 1.

[0025] Note that, in order to produce predetermined colors, the coloration layer 31c is not limited to one layer, and may be formed as a plurality of layers. Furthermore, the foil layer 31A is approximately 0.2 to 1 mm thick, and therefore, even when this is thermocompressively bonded on the control panel 1, the unevenness is extremely slight.

[0026] Note that thermoplastic resins such as PS or AS are preferred as materials for the control panel 1, which receives the transfer. Furthermore, in the figures, 31f indicates lead lines, which are formed already connected to the sensor layer 31b.

[0027] FIG. 8 and FIG. 9 show another formation method using in-molding, wherein the foil layer 31A, comprising the adhesion layer 31a, the sensor layer 31b, the coloration layer 31c and a surface layer 31g is set in a mold, and a thermoplastic resin such as PS or AS, as mentioned above, is injected from the adhesion layer 31a side, so as to form the foil layer 31A and a resin layer 30A as a single body.

[0028] Note that, in the drawings, reference symbol 31f indicates a lead lines, and reference symbol 31h indicates a connector that is subsequently fitted on the lead lines 31f.

[0029] FIG. 10 shows another formation method using the vacuum method, in which the foil layer 31A, comprising, for example, the aforementioned adhesion layer 31a, the sensor layer 31b, the coloration layer 31c and the separation layer 31d, is thermally deformed in advance, as in (a), by way of the vacuum method, and the resin layer 30A, made from thermoplastic resin such as PS or AS, as mentioned above, is formed on the inside of this thermally deformed foil layer 31A as in (b).

[0030] Note that a foil layer 31A and a resin layer 30A of this sort may be manufactured separately, and thereafter united by way of hot pressing or the like, which is to say, formed by way of the lamination method.

[0031] FIG. 11 is a simple representation of the constitution of a control system for controlling a controlled circuit unit 44 that controls replay of a video signal and adjusts volume up/down on the basis of the detection signal from the capacitance type touch switch unit 30. As shown in this figure, when a sensor unit 31 is touched by a finger, a capacitance change detector 40 detects changes in the capacitance. A wave shaping unit 41 converts the results of detecting the changes in the capacitance by the capacitance change detector 40 to a digital signal.

[0032] A control unit 43 controls the operations of the controlled circuit unit 44, which is a replay mechanism,

an amplification circuit or the like, on the basis of the digital signal from the wave shaping unit 41.

[0033] Here, on/off states and on/off changes in the sensor units 31, which are caused by a finger, are determined, for example, in the following manner. That is to say, if, for example, the width of the output pulse from the wave shaping unit 41 is large, it is determined that the speed at which the finger tracing the sensor units 31 is turning is slow. Meanwhile, if the width of the [output] pulse from the wave shaping unit 41 is narrow, it is determined that the speed at which the finger tracing the sensor units 31 is turning is fast.

[0034] FIG. 12 shows another embodiment in a case wherein the manner in which the sensor units 31are disposed on the switch unit 30, described above, has been changed. Note that, in this figure, the sensor units 31A and 31B are shown as being circular, but [the configuration] is not limited to this example, and this may be a chrysanthemum pattern as described above.

[0035] In this example, 2 pairs of the sensor units 31A and the sensor units 31B are provided, and sensor-free parts 31X are interposed between the sensor units 31A and the sensor units 31B, all of these being disposed in a circle. Changes in the capacitance of the sensor units 31A, 31B are detected by the capacitance change detection units 40A, 40B respectively.

[0036] Here, the number of each of the sensor units 31A and the sensor units 31B is such that, with a sensor unit 31A, a sensor unit 31B, and a sensor-free unit 31X as one set, a plurality of sets (2 sets in this example) are provided.

[0037] However, in terms of the gap between sensor adjacent units 31A and sensor units 31B it is preferable that these be separated to an extent at which the sensor unit 31A and the sensor unit 31B can [both] be touched by bridging across with a finger. Consequently, as described below, an & output can be produced from the sensor unit 31A and the sensor unit 31B, whereby the direction in which the finger is turning can easily be determined. However, in cases of a density such that a finger bridges across and touches 3 or more of the sensor units 31A and 31B which are arranged in a circle, it is difficult to differentiate the direction in which the finger is turning; and therefore this is undesirable. Note that the sensor-free parts 31X are necessary so as to create a situation in which neither a sensor unit A nor a sensor unit B is touched.

[0038] Furthermore, the guide groove or guide protrusion described above may be provided along the dotted line shown in this figure.

[0039] So long as the aforementioned conditions can be met, in extreme cases, a constitution is also possible wherein only one set of a sensor unit 31A and a sensor unit 31B is provided, for example, as shown in FIG. 13.

[0040] Here, if the outputs when the sensor units 31A and the sensor units 31B are touched with a finger are taken as A and B respectively, the output change when turning to the right, for example, is A→A&B→B→0→A→A&B→B→0 etc. Conversely, when turning to the left this is B→A&B→A→0→B→A&B→A→0.

[0041] The shaped wave output of the wave shaping unit 41B is applied to the clock inputs of the flip-flops 16, 17 via an inverter 180, and the flip-flops of 16, 17 are triggered by the falling edge of the pulse via the inverter 180.

[0042] Now, when a finger is turned in the clockwise direction and the finger touches the sensor unit 31B the output of the inverter 180 goes from high-level to low-level, the flip-flop 16 is triggered by the falling edge thereof, and logical 1 is produced at the Q output. This signal is used as an interrupt signal for a control unit, and when the control unit receives this, it applies a reset signal to the R input of the flip-flop 16 so as to reset it. Consequently, a pulsed signal corresponding to the number of times that the sensor unit 31B has been touched, which is to say, corresponding to the amount of rotation, is produced.

[0043] The direction of rotation is determined according to the Q-bar output of the flip-flop 17. In other words, the sensor units being touched changes in the manner of A→A&B, and upon generation of the clock signal that is generated when B is touched, the A [signal] is 1, and therefore the D input to the flip-flop 17 is 0. Thus, this data D is expressed by Q-bar in accordance with the clock signal, and therefore a 1 is produced as the rotation direction signal.

[0044] Accordingly, when the finger is turned in the clockwise direction, logical 1 is generated at the Q-bar output of the flip-flop 17, and when the finger is turned in the anticlockwise[1] direction, logical 0 is generated at the Q-bar output of the flip-flop 17.

[0045] Note that, if the unit that is first touched by the operator is B, or A&B, the rotation signal may be wrong when the first clock signal is generated, but if this presents a problem, for example, the control unit can be caused not to operate at the time of the first clock signal.

[0046] FIG. 14 shows a situation wherein the detection method illustrated in FIG. 12 is performed by software, showing an example in which the frequency and volume are turned up/down. In this example, two sets of sensor a unit 31A, a sensor unit 31B and a sensor unit 31C are disposed in a circle. Furthermore, corresponding sensor units 31A, sensor units 31B and sensor units 31C in each set are connected to each other, and the outputs thereof are read by a sensor detection circuit 50. Note that noise, which is a cause of malfunction for detection outputs from the sensor units 31A, the sensor units 31B and the sensor units 31C, is eliminated by the sensor detection circuit 50.

[0047] The detection results from the sensor detection circuit 50 are read by a CPU 51, via an I/O port 52. The CPU 51 outputs up, down and count pulse signals according to a predetermined program.

[0048] FIG. 15 shows a table of on/off combinations for the sensor unit 31A, the sensor unit 31B, and the sensor unit 31C. Note that, in this figure, sensor unit 31A, sensor unit 31B and sensor unit 31C are indicated by A, B and C, respectively.

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[1] *There is a typographical error in the original Japanese at this point.*

[0049] With such a constitution, the CPU 51 determines the on/off states and the on/off changes [produced by]

the finger according to the [processing] flow in FIG. 16. In other words, the on/off states of the sensor units 31a, the sensor units 31B and the sensor units 31C are scanned and an N corresponding to the on/off combination is determined according to the table in FIG. 15 (step 1601). In cases where N corresponds to any of 1, 2 or 4 (step 1602), a time count value T is reset to 0 (step 1603) and after performing a second scan, N is likewise determined based on the table in FIG. 15 (step 1604).

[0050] In cases where N corresponds to any one of 1, 2 or 4 (step 1605), the difference between N2 at the time of the second scan and N1 at the time of the first scan is found and a judgment is made as to whether or not N2 - N1 is 0 (step 1606). If N2 - N1 is not 0, the value of T, which is the time count value, is stored (step 1607).

[0051] Next, a judgment is made as to whether or not the absolute value of N2 - N1 is 3 (step 1608) and if this is judged to be 3, a judgment is made as to whether or not N2 - N1 is less than 0 (step 1609). If this is judged to be less than 0, an up pulse signal is output (step 1610).

[0052] When the up pulse signal is output, for example, if T is greater than or equal to 100 msec, the count pulse is output once, and at less than 100 msec, the count pulse is output twice (step 1611).

[0053] Conversely, if it is judged in (step 1608) that the absolute value of N2 - N1 is not 3, a judgment is made as to whether or not N2 - N1 is greater than or equal to 0 (step 1612). If it is judged that this is greater than or equal to 0, (step 1610) is preceded to. Moreover, in cases where it is judged that N2 - N1 is not greater than or equal to 0 and in cases where it is judged that N2 - N1 is not less than 0, in (step 1612) and (step 1609) respectively, a down pulse is output (step 1613). In outputting count pulses, (step 1611) is followed.

[0054] Thus, count pulses corresponding to the direction of rotation (up/down) and the speed of rotation can be produced; and this is described in more detail.

[0055] That is to say, the fact that any one of A, B or C has been touched is detected in (step 1602). Here, situations in which the finger touches and bridges across 2 or 3 [sensors] are excluded. (Step 1605) is the same, but in (step 1606) a check is made as to whether or not there has been a change with respect to the previous scan, and if there has been a change, the time T taken up for this is stored in (step 1607).

[0056] (Step 1608) will be Yes when the Ns are a 4 and a 1, which is to say, when there has been a movement between A and C. Next, the magnitude correlation is determined in (step 1609) so as to understand which has been moved to; for example, if N2 is less than N1, it is determined that the movement was from C to A, which is to say, that the direction of rotation was clockwise, and an up pulse is output. At this time, if T is less than a predetermined value, the rotational speed is recognized as being fast, and more pulses are generated per unit of time so as to cause rapid changes in the frequency or volume steps.

[0057] Meanwhile, (step 1608) will be No when there is a change between A/B and B/C, and in this case, as will be understood from FIG. 15, the direction of rotation can be understood simply from the magnitude correlation, which is determined in (step 1612). Note that the number of sensor units, and whether or not to use the fact that a plurality of sensor units are touched by way of bridging across them as a condition for determination, as well as rotational speed levels and the like can be established as is suitable.

[0058] FIG. 17 shows another embodiment in a case wherein functions have been assigned to the switch unit 30; in the same manner as described above, the sensor units 31A, 31B, 31C etc. are disposed in a circle. The various sensor units 31A, 31B, 31C etc. are endowed with selection modes, for example, for a tuner, a VCR, a tape deck, and other types of appliances.

[0059] Then, after selecting the operating mode by touching any of the sensor units 31A, 31B, 31C etc., [the device] switches to detection mode, in which the sensor units 31A, 31B, 31C etc., for example, turn the volume up/down as described above.

[0060] Furthermore, for example, after selecting the tuner by touching the sensor unit 31A, if the sensor units 31A, 31B, 31C etc. are traced in a turn to the right, the volume is turned up, and if traced in a turn to the left, the volume is turned down. Furthermore, this may be such that, for example, by touching the sensor unit 31A twice, the operating mode is caused to be such that the frequency is turned up/down by the sensor units 31A, 31B, 31C etc., and in this case, by tracing the sensor units 31A, 31B, 31C etc., for example, in a turn to the right, the selected frequency is increased, and by tracing in a turn to the left, the selected frequency is decreased.

[0061] FIG. 18 shows another embodiment of the switch unit 30; the sensor units 31A, 31B, 31C etc. are disposed in a circle and a common electrode 60, such as ground, is disposed between each of the sensor units 31A, 31B, 31C etc. By means of such a constitution, malfunctions can be prevented, and a circuit for capturing changes in capacity between the common electrode and the sensor units can be used.

[0062] FIG. 19 shows another embodiment in a case wherein the sensor units 31A, 31B, 31C etc. are disposed in a matrix. In this example, the level of a predetermined band is, for example, turned up/down by each row of the sensor units 31A, 31B, 31C etc., which is to say, this is given a graphic equalizer function.

[0063] In other words, the various levels are assigned bands dividing 20 Hz to 20 kHz into four equal parts; for example, if the first row is made the high frequency band, by tracing the sensor units 31A, 31B, 31C etc., for

example, to the right, the level of the high frequency band can be turned up, and conversely by tracing to the left, the high frequency band can be turned down.

[0064] FIG. 20 shows another embodiment in a case wherein the switch unit 30 is horizontally aligned. In this example, the sensor units 31A, 31B, 31C etc. may be assigned selection modes for the tuner or the like, as described above, and furthermore by tracing these sensor units 31A, 31B, 31C etc. in the crosswise direction, the volume can be turned up/down and the frequency can be turned up/down.

[0065] FIG. 21 shows another embodiment in a case wherein the sensor units 31 of the switch unit 30 are rectangular, and the sensor units 31 are disposed in two vertical rows. In this example, by tracing with the finger in the vertical direction as shown by the arrow X, or by tracing the sensor units 31 in an orbiting manner, as shown by the arrow Y, the volume can be turned up/down and the frequency can be turned up/down and the like, as described above. Furthermore, the sensor units 31 can be assigned selection modes for the tuner or the like, as described above. Furthermore, in this example, the sensor units 31 are rectangular, and therefore it is also possible to put symbols, characters or the like on the sensor units 31 for [indicating] operating modes or the like.

[0066] FIG. 22 shows another embodiment in a case wherein the sensor units 31 are disposed in one vertical column, the sensor units 31 forming an arch. In this example, by tracing with a finger in the up or down direction as shown by the arrows X, or by tracing with a finger an orbiting manner, as shown by the arrow Y, the volume can be turned up/down and the frequency can be turned up/down and the like, as described above.

[0067] FIG. 23 to FIG. 24 show an embodiment in a case wherein the switch unit is of the optical type, an optical switch unit 70 being embedded in the control panel 1. Light from a light emitting diode 71 of the optical switch unit 70 is guided into an annular groove 75 by way of reflecting surfaces 72, 73, 74. The light that is guided to the groove 75 is guided by light guide members 77, 78, both ends of which being photoreceptor units, and received by the photoreceptor units 77, 78.

[0068] The light guide members are paired so as to form a 60° angle with respect to each other, and by turning a finger in the groove 75, the light guided to the photoreceptor units 77, 78 is interrupted at a certain relationship. Accordingly, by turning the finger to the left and the right, it is possible to turn the volume up/down and to turn the frequency up/down and the like, as described above. Furthermore, by making the light from the light emitting diode 71 visible light, the interior of the groove 75 is lighted, whereby an illumination effect can be produced.

[0069]

[Effects of the Invention] As described above, according to the jog-dial switch of the present invention, the direction of rotation and the amount of rotation is detected on the basis of the contact or non-contact based on/off status and/or the changes in detection units disposed on a surface, so that a conventional rotary member can be rendered unnecessary. Furthermore, for example, by causing the switch unit to be of the film type, the places in which this can be disposed are not limited to flat surfaces, but rather this can also be disposed on a curved surface.

[0070] Furthermore, the operational trajectory is not limited in the way that it is when a conventional rotary member is used, and because the rotational movement of the finger can be in any shape, operations can be performed easily.

[0071] As a result, the thickness of the control panel can be reduced and operability can be improved with a simple constitution.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[FIG. 1] is a perspective view showing a conventional jog-dial switch.

[FIG. 2] is a sectional view showing the jog-dial switch of FIG. 1.

[FIG. 3] is a plan view showing the disk provided in the rotary encoder of FIG. 2.

[FIG. 4] is a drawing for the purpose of explaining the operating principles of the rotary encoder of FIG. 2.

[FIG. 5] is a perspective view showing a jog-dial switch of the present invention.

[FIG. 6] is a front view showing a method of operating the switch unit of FIG. 5.

[FIG. 7] is a drawing showing a method of manufacturing the switch unit of FIG. 5.

[FIG. 8] is a drawing showing a method of manufacturing the switch unit of FIG. 5.

[FIG. 9] is a drawing showing another method of manufacturing the switch unit of FIG. 5.

[FIG. 10] is a drawing showing another method of manufacturing the switch unit of FIG. 5.

[FIG. 11] is a drawing showing the constitution of a control system for the purpose of controlling the operations of a controlled circuit unit on the basis of a detection signal from the switch unit of FIG. 5.

[FIG. 12] is a drawing showing another embodiment in a case wherein the constitution of the switch unit of FIG. 5 has been changed.

[FIG. 13] is a drawing showing another embodiment in a case wherein the constitution of the switch unit of FIG. 12 has been changed.

[FIG. 14] is a drawing showing another embodiment in a case wherein the constitution of the switch unit of FIG. 12 has been changed.

[FIG. 15] is a drawing showing the on/off combinations for the sensor unit of FIG. 14.

[FIG. 16] is a flowchart showing a case in which the detection method using the switch of FIG. 14 is performed by way of software.

[FIG. 17] is a drawing showing another embodiment in a case wherein the constitution of the switch unit of FIG. 14 has been changed.

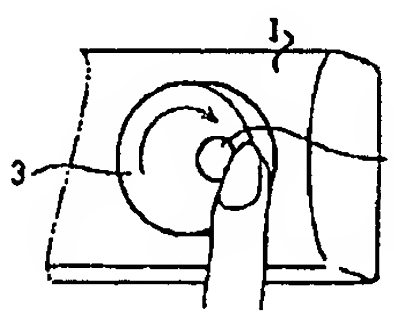
[FIG. 18] is a drawing showing another embodiment in a case wherein the constitution of the switch unit of FIG. 17 has been changed.

[FIG. 19] is a drawing showing another embodiment in a case wherein the constitution of the switch unit of FIG. 18 has been changed.

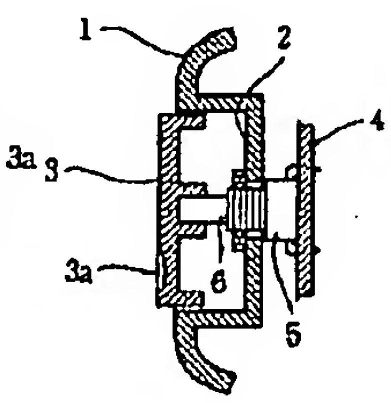
[FIG. 20] is a drawing showing another embodiment in a case wherein the constitution of the switch unit of FIG. 19 has been changed.
[FIG. 21] is a drawing showing another embodiment in a case wherein the constitution of the switch unit of FIG. 20 has been changed.
[FIG. 22] is a drawing showing another embodiment in a case wherein the constitution of the switch unit of FIG. 21 has been changed.
[FIG. 23] is a sectional view showing an embodiment in a case wherein the switch unit of FIG. 5 is of the optical type.
[FIG. 24] is a plan view showing a photoreceptor unit in the switch unit of FIG. 23.

[Explanation of the Reference Numerals]
1 control panel
30 switch unit
31 sensor unit
31A foil layer
40, 40B capacitance change detection units
41, 41B wave shaping units
16, 17 flip-flops

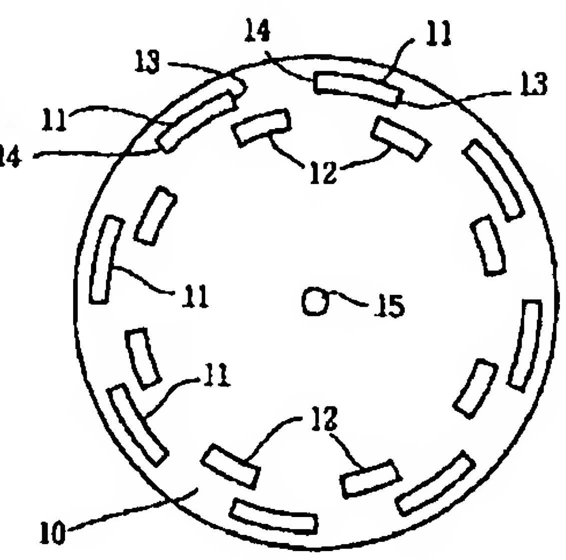
[FIG. 1]



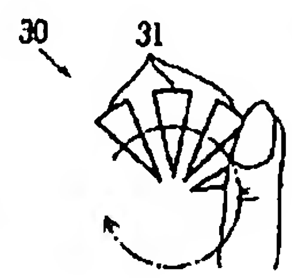
[FIG. 2]



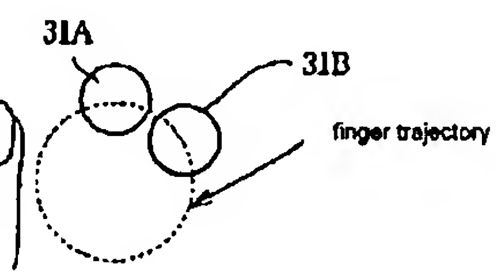
[FIG. 3]



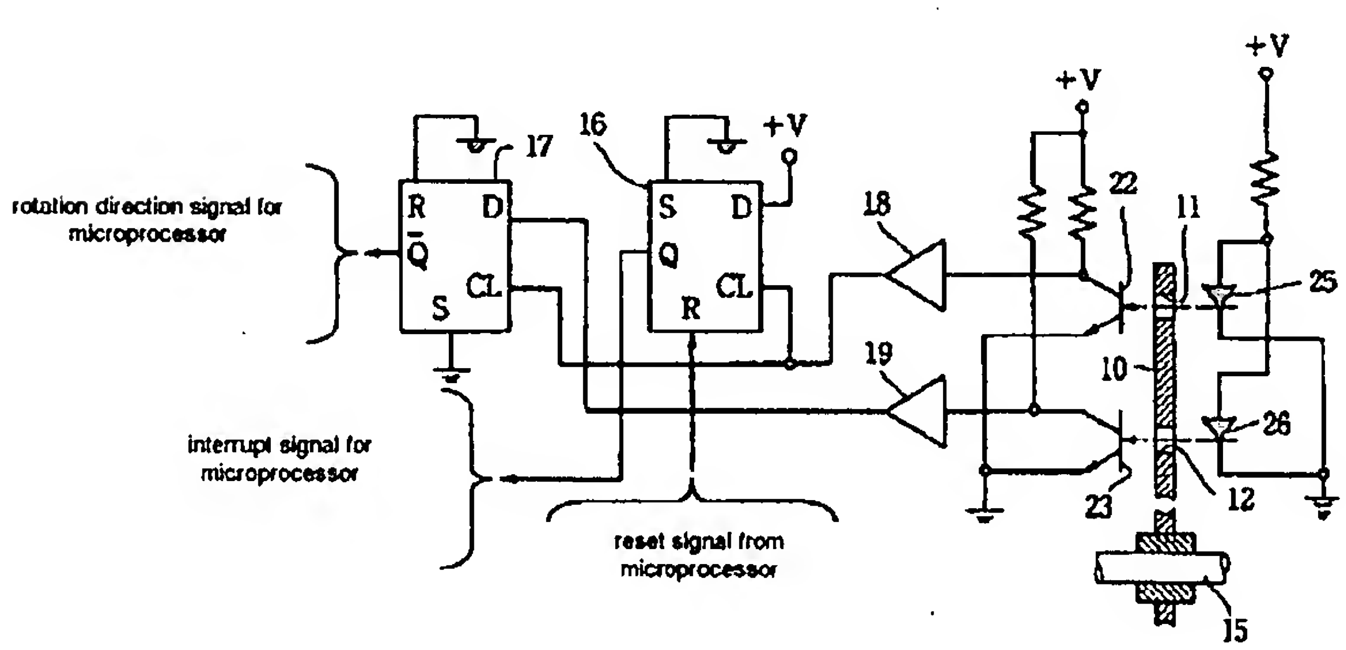
[FIG. 6]



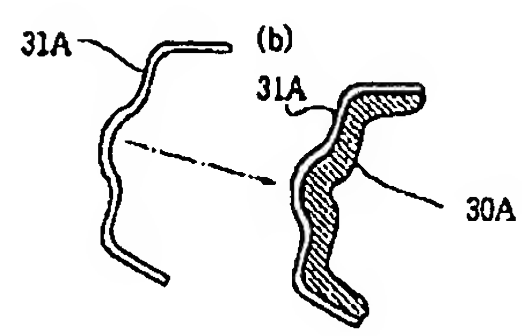
[FIG. 13]



[FIG. 4]



[FIG. 10]



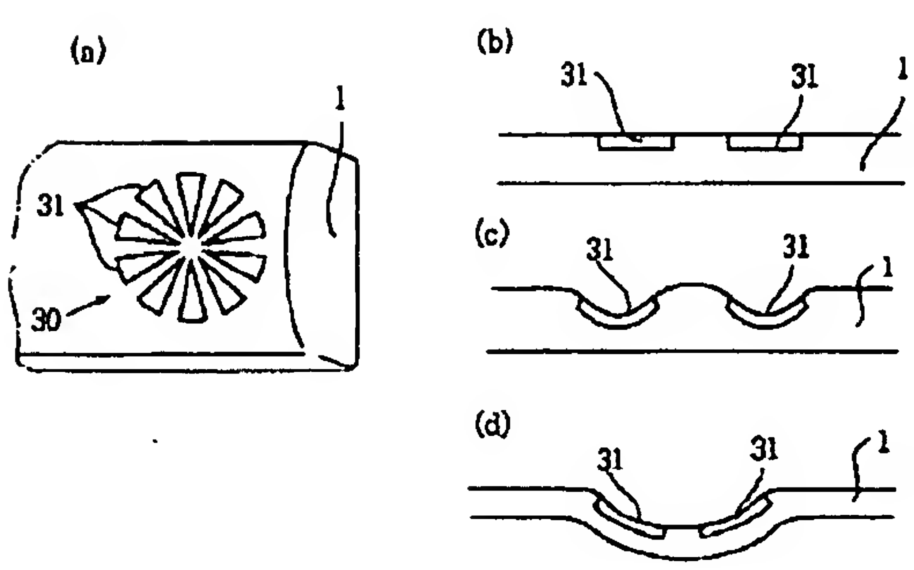
[FIG. 15]

on/off combinations

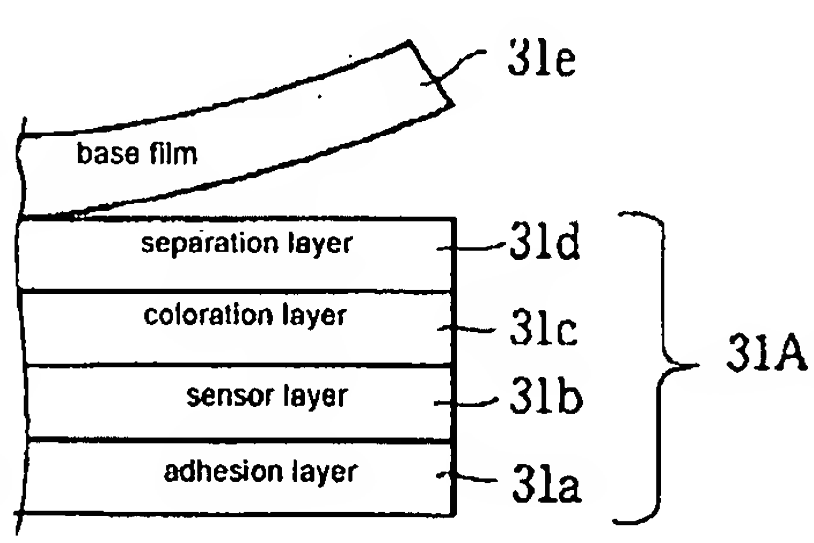
	センサー		
N	A	B	C
0	×	×	×
1	○	×	×
2	×	○	×
3	○	○	×
4	×	×	○
5	○	×	○
6	×	○	○
7	○	○	○

○…… on
×…… off

[FIG. 5]

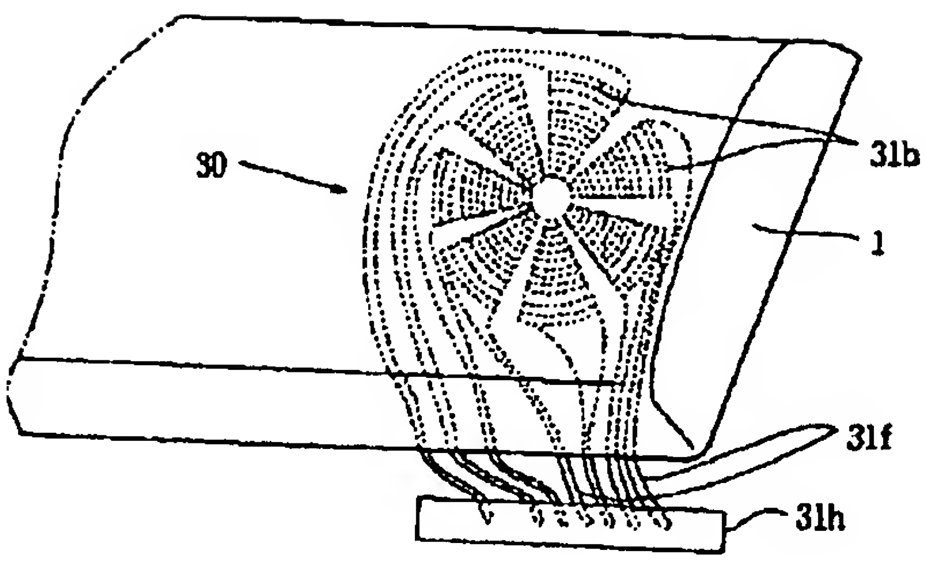


[FIG. 7]

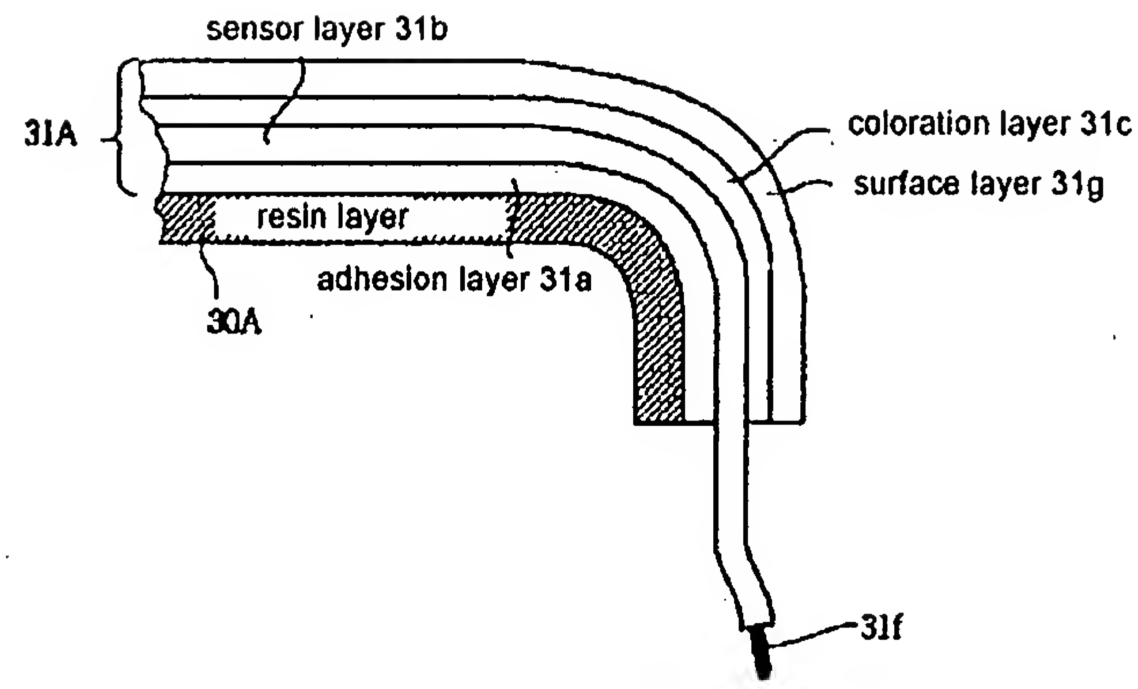


tk-244879

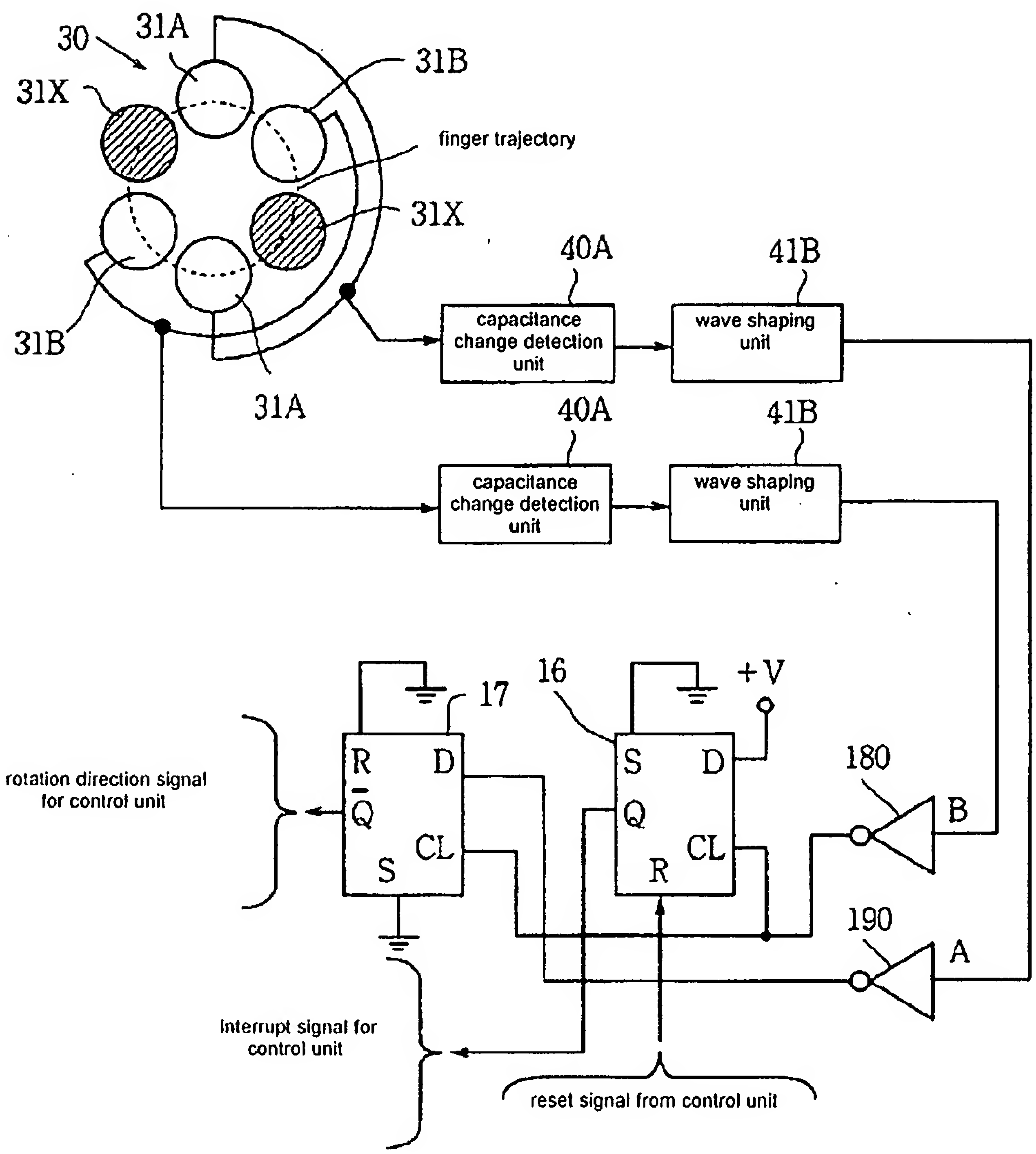
[FIG. 8]



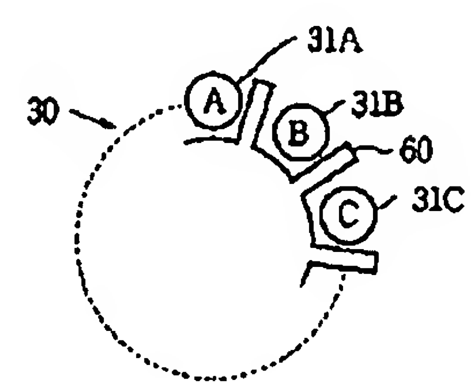
[FIG. 9]



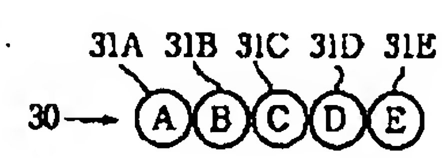
[FIG. 12]



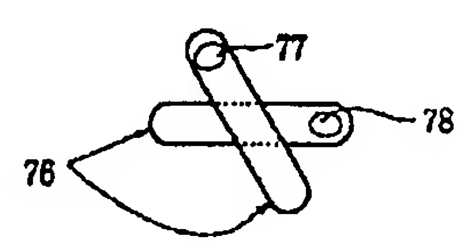
[FIG. 18]



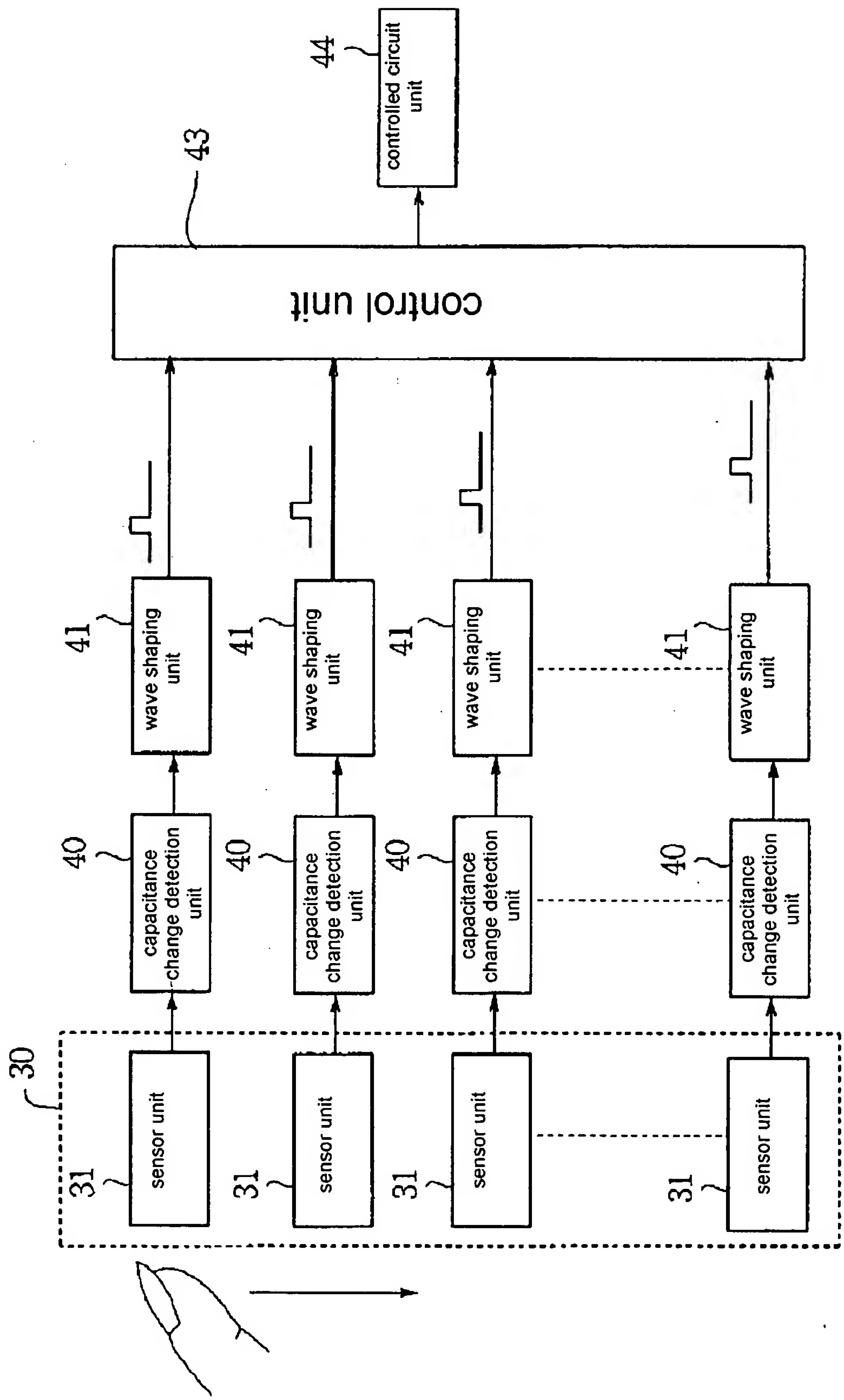
[FIG. 20]



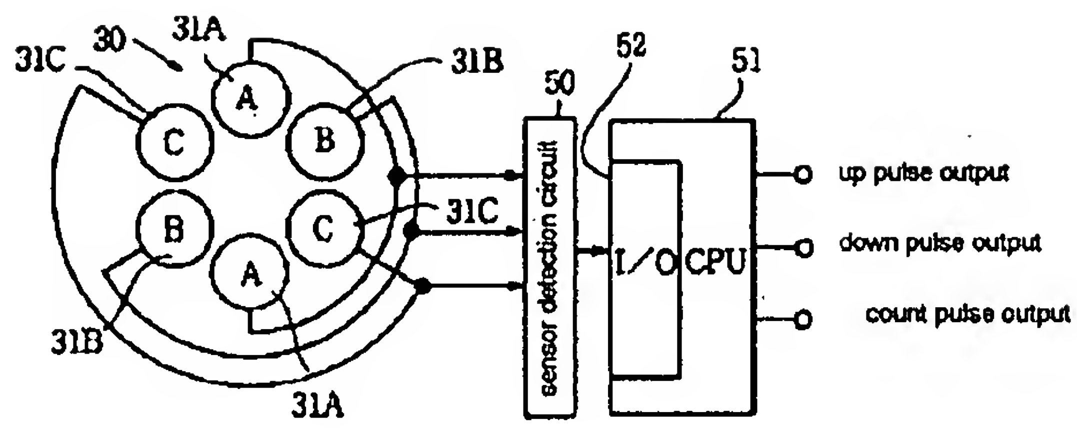
[FIG. 24]



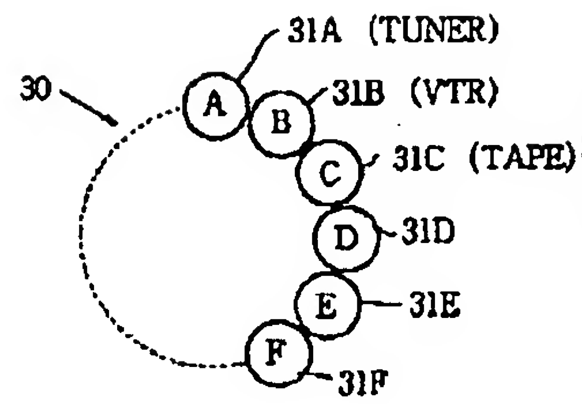
[FIG. 11]


controlled circuit unit
44
43
control unit
wave shaping unit
41
capacitance change detection unit
40
sensor unit
31
30

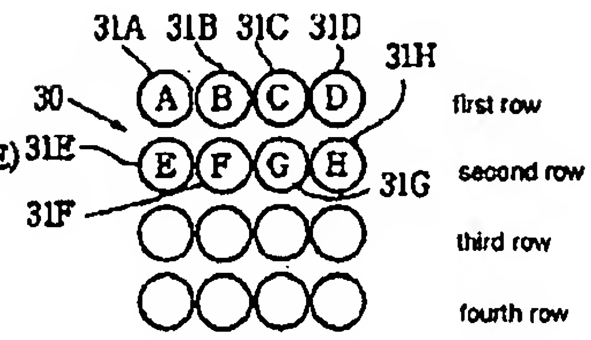
[FIG. 14]



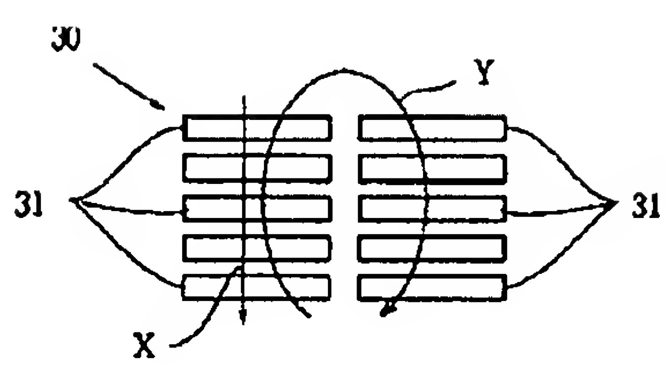
[FIG. 17]



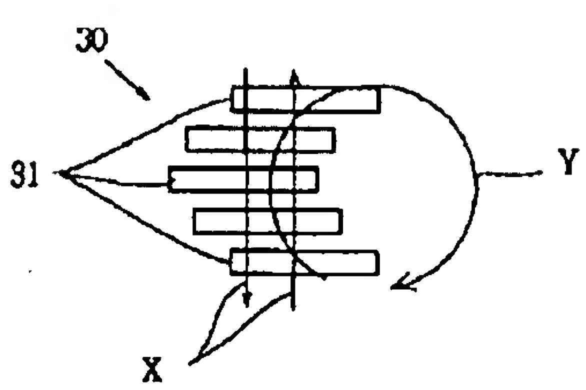
[FIG. 18]



[FIG. 21]



[FIG. 22]



[FIG. 23]